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ABSTRACT

North Seattle Community College decided to integrate computer-aided design/drafting (CAD/D) into its Electro-Mechanical Drafting Program. This choice necessitated a redefinition of the program through new curriculum and course development. To initiate the project, a new industrial advisory council was formed. Major electronic and recruiting firms were chosen to represent the opinion of the area's industry. A formal link was established with the allied vocational programs in the Seattle Public Schools and a future curriculum and registration arrangement was made with Shoreline Community College. A five-year plan was described by the advisory council to the college's administration outlining curriculum changes, equipment needs, facilities requirements, and added instructional needs. Following industry visits, a job description for a CAD/D instructor was developed and CAD equipment and funding from IBM were acquired. Finally, three curriculum plans were developed; scope and sequences of the plans were compiled; course outlines in the core curriculum area were written; and course outlines in allied fields were also developed. (The scope and sequences and course outlines make up the bulk of this report.) (KC)

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REVISION OF ELECTRO-MECHANICAL DRAFTING PROGRAM TO INCLUDE CAD/D(COMPUTER-AIDED DRAFTING/DESIGN)

FINAL REPORT

Project No. 84-ASN(148)NB

Curriculum Development Project
Conducted Under Public Law
94-482

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December 31, 1984

RESEARCH COORDINATING UNIT
Washington State Commission for Vocational Education

CE041087

FINAL REPORT

Project No, 84-ASN(148)NB

REVISION OF ELECTRO-MECHANCIAL DRAFTING PROGRAM TO INCLUDE CAD/D (COMPUTER-AIDED DRAFTING/DESIGN)

Curriculum Development Project
Conducted Under Public Law 94-482

The project reported herein was performed pursuant to a grant from the Research Coordinating Unit of the Washington State Commission for Vocational Education. Contractors undertaking such projects under the Commission for Vocational Education sponsorship are encouraged to express freely their professional judgement in the conduct of the project. Points of view of opinions stated do not, therefore, necessarily represent official Commission for Vocational Education position or policy.

Nancy V. Snyder
North Seattle Community College
9600 College Way N.
Seattle, WA 98103

December 31, 1984

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Report Summary

Over several years of instructional development and changes in the industry, conclusions were being drawn toward radical changes in the Electro-Mechanical Drafting Program at North Seattle Community College. The impetus for this project to take place was the forth-comming inclusion of CAD/D equipment into the program. The choice to incorporate and integrate the use of the equipment into the program rather than to tack its use on to the end of the studies necessitated a redefinition of the program through new curriculum and course development. At the same time CAD/D was to be integrated into the new curricula, other technical and job-related, allied skills were identified as pertinent to the program's interest.

To initiate the project a new industrial advisory council was formed. Major electronic and recruiting firms were chosen to represent the opinion of the area's industry. A formal link was established with the allied vocational programs in the Seattle Public Schools and a future curriculum and registration arrangement was made with Shoreline Community College. North Seattle actively participated in the Six-College Consortium funded by H.B. 3155 to write equipment descriptions, benchmark systems, and recommend purchases. A five-year plan was described by the advisory council to the college's administration to outline curriculum changes, equipment needs, facilities requirements, and added instructional needs. Several instructors and administrators of NSCC became members of Northwest Cad Users Association and multiple industry visits were made. A job description for a CAD/Design Instructor was developed and Cad equipment and funding from IBM was solicited and granted, adding two more CAD stations to the instructional environment. Finally, three curriculum plans were developed; scope and sequences of them were compiled(see Appendix A); course outlines in the core curriculum area were written (Appendix B); and course outlines in allied fields were also developed.

After one quarter of instruction with the new program in place, and concluding the scope of this project, the following observations are made:

* Short and long range planning are essential to meet the needs created by on-going changes in the technology.
* An industrial advisory board is required for program definition, equipment purchases and instructional content.
* An individual chartered with program planning, definition and organization is best chosen from the instructional cognizent level.
* Bringing CAD/D systems into an instructional environment requires dedicated funding for the equipment,facilities, curriculum planning, instruction, and student intake and advising.

Problem Area Addressed

"While an electro-menchanical drafting curriculum remains viable to area electronics industry need, the rapid, widespread use of computers in industry to accomplish the drafting function demands immediate educational response. Four years ago an electro-mechanical drafting program was perceived as a state-of-the-srt curriculum, a specialization of the drafting discipline...Today, it is a basic skills curriculum, requiring further specialization and allied discipline training.

The industry profile of an electro-mechanical drafter has expanded to describe an individual comprehensively trained (1) in the basic skills of drafting, (2) CAD/D systems awareness, (3) basic programming capabilities and (4) good communication and math skills. The present program does not adequately integrate these requirements..."--from the project proposal, page 3.

A secondary problem, as a result of the program changes, is that the scope of the two degree options is closely approaching a three-year curriculum. Hopefully, without sacrificing program content and student competency, the number of credit hours will be reduced to remain below 120 hours. This will be accomplished through a combination of more flexible scheduling of lab courses and more prerequisites for program entry.

Project Objectives

The project goal was "to change the Electro-Mechanical Drafting Program at North Seattle Community College to respond to the computerization of the drafting function in industry." (Project proposal, page 4)

The sub-objectives included (1) a revision of the "Electro-Mechanical Drafting Program from a 4-quarter clock hour, vocational preparatory certificate program, to a well-integrated 2-year degree program to include CAD/D systems applications and basic computer competency by December 31, 1984.", (2)"...a curriculum plan which integrates present electro-mechanical drafting and allied support instruction with CAD/D systems training, and computer literacy.", (3)"...a sequence of CAD/D laboratory experiences...", (4)"...an instructor's guide...", and (5)"...a program articulation plan with area high school and community college programs."

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Project Design

To meet the goal of the project and several of its sub-objectives,the target program was assessed as to its industry relevancy and breadth of information. The single curriculum was defined into three curricula-one certificate option in Electro-Mechanical Drafting and two degree programs, one in Electronic Drafting, the other in Electronic Packaging/Design. The original courseware was retained where useful. Under all three new curricula, new courses were developed in drafting, design concepts, CAD/D, electronic surveys,and interpersonal skills. Allied courses in math and language skills, machining practices and computer programming were sequenced into the new curriculum.

Student Population

As in all areas at the Community College, there is an increased number of students enrolling in the program with other advanced degrees, allied skills and responsible work experiences. Many are intentionally changing careers, and many are retraining because of changing technologies. There are fewer women returning to work and fewer non-native speakers than in the first five years of the program. The median age is 28 years and there is a 40%/60% female to male mix. There is an increased number of students electing to complete a AA Degree. Most students are (1) working P/T in the field, (2)working P/T in any field or (3) receiving tax-based funding.

Instructional Organization

Program entry takes place within the first two weeks of any quarter. Advanced placement and course waivre are considered for eligible students. Program entry is dependent upon arithmetic and basic English language competencies; scores describing spacial relations aptitudes and other indicators of potential program success; and high school completion or the equivalent. The first two quarters serve as introduction to the curriculum choices and industry definitions. By the third quarter the student must declare his chosen curriculum and must begin the CAD/D instructional sequence. The first year is concluded with the completion of the 3rd quarter. The last three quarters are considered the second year and the advanced portion

of the curricula which emphasize design concepts and the use of CAD as a design tool.

Instructional Staff

There are two core curriculum instructors, both having had industrial experience in electronic instrumentation, one electronics theory instructor, one interpersonal skills instructor with a background in Public Administration, and instructors from the math and English departments. This project has provided the motivation to draw upon the expertise of several instructors from diverse areas. One instructor is a faculty member at Shoreline Community College and two others are vocational educators in the Seattle Public Schools.

Facilities

The instruction for the core curriculum areas takes place in a drafting lab and adjacent lecture/library rooms. A separate, adjacent room is the CAD/D lab, containing four user stations, two plotters and reference tables.

Equipment

The CAD hardware includes a Lomas computer (IBM PC compatible), a Visual 500 monitor and keyboard, a GTCO graphics pad, and an HP plotter. The operations software is MSDOS; the applications program is 4DCAD. The drafting lab is equipped with twenty Hamilton drafting tables with Vemco track machines. There are four electric-powered light tables, three flat files and one diazo blueprint machine.

Results and Accomplishments

While one quarter of instruction is too soon to draw resulting conclusions, there appears to be trend toward increased job placement for exiting students. Certainly the project has inspired integration of instruction from other discipline areas on campus.

The following lists the accomplishments achieved within the scope of this project:

1. Total program revision from a four-quarter clock hour certificate program to a two-year degree program.
2. Definition of three curriculum choices
3. Course outlines for all core curriculum classes
4. Development of an industrial advisory council
5. Inclusion of CAD/D instruction, computer literacy, electronics surveys, machining, and interpersonal skills in the work place
6. Development and achievement of a second instructional position for CAD/D and Electro-Mechanical Design.
7. Planning and organization of new lab facilities
8. CAD/D equipment purchase
9. Establishment of a program link with Seattle Public Schools and Shoreline Community College.

Evaluation

An evaluation of the results of the project by the industrial advisory council are pending. A preliminary evaluation was conducted by the group to insure basis literacy and competencies are addressed. The evaluation was favorable. An administrative evaluation concluded the number of credit hours for the degree programs be reduced. Student evaluation spoke favorably to the breadth of choices offered under the new options. The quarter load, however, is too heavy. Also, the students observed that the program intake and registration procedures have been affected.

Conclusions/Implications/Recommendations

Based on evaluations and instructor observations:

1. Credit hour requirements will be reduced
2. More prerequisite requirements for program entry will include English 101 and Technical Math(intermediate algebra).
3. The drafting/design classes will be more flexibly scheduled.
4. More CAD/D stations will be purchased.
5. The CAD/D curriculum will become , in part, a support instructional area for electronic technician students.
6. Students will be required, without exception, to have completed a class in programming and a minimum of two quarters of drafting to enroll in the first CAD class.
7. Survey of Electronics II will include a unit on programming in PASCAL.
8. CAD/D instruction is machine intensive and therefore,student and other paid monitors will manage the majority of CAD/D laboratory time.

Project dissemination

The scope and sequences and course outlines are being published in this report which serves as its off-campus dissemination. All instructors, administrators and staff associated with the program will also be copied.

NORTH SEATTLE COMMUNITY COLLEGE

VOCATIONAL EDUCATION
Electronics Division

ELECTRO-MECHANICAL DRAFTING TECHNICIAN
CERTIFICATE OPTION

	COURSE NO.	REQUIRED COURSES Suggested Sequence	LECTURE HOURS	LAB HOURS	CREDIT HOURS	TOTAL CREDITS
1st.	EDR 151	Electro-Mechanical Drftg. I	55	165	12.5	
Qtr.	MAT 111	Technical Math-Algebra	55	0	5.0	
	ENG 101	Composition	55	0	5.0	22.5
2nd.	EDR 152	Electro-Mechanical Drftg. II	55	165	12.5	
Qtr.	MAT 112	Technical Math-Alg/Trig.	55	0	5.0	
	EET 151	Intro. to Programming-BASIC	55	0	5.0	22.5
3rd.	EDR 153	Electro-Mechanical Drftg. III	55	165	12.5	
Qtr.	EDR 163	Intro.to CAD for Electro-Mech.Drftg.	22	44	4.0	
	ENG 108	Technical Report Writing	55	0	5.0	21.5
4th.	EDR 251	Advanced Circuitry I	55	165	12.5	
Qtr.	EDR 261	CAD for 2D Applications I	22	44	4.0	
	EET 110	Survey of Electronics I	22	22	3.0	19.5
			TOTAL REQUIRED CREDITS			84

SUBSTITUTIONS/COURSE WAIVERS/ADVANCED PLACEMENT

1. ADVANCED PLACEMENT is available by instructor's permission only for EDR 151,152,153.
2. COURSE WAIVER is available for ENG 101, MAT 111, 112, EET 151, 110, where proof of equal or greater competency is submitted and approved by instructor(s).
3. MAT 111, 112 may be substituted by MAT 101 & 105.
4. ENG 108 may be substituted by SPE 100.

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MAJOR EMPHASIS COURSES:

EDR 151 ELECTRO-MECHANICAL DRAFTING I (12.5)
An introduction to the basic skills of mechanical drafting as they relate to the electronics manufacturing industry. This course describes the industrial environment and employment arenas for an entry level electro-mechanical drafter. Emphasis is placed on appropriate technical and social behavior to compliment the target industry. Course content includes: Basic mechanical drafting concepts, ANSI, MIL-STDS, descriptive geometry, beginning mechanical assemblies.

EDR 152 ELECTRO-MECHANICAL DRAFTING II (12.5)
Emphasis on advanced mechanical assemblies; advanced dimensioning and tolerancing, fasteners, subassy's and final assemblies. Introduction to sheet metal drafting for electronics packaging; dimensioning format, fasteners, flat patterns, fabrication processes.

EDR 153 ELECTRO-MECHANICAL DRAFTING III (12.5)
Drafting for electronics including schematic diagrams, logic diagrams and introduction to printed circuit board generation-layout, artwork and documentation. Symbology, reference designations, diagram format, component representation, board outline parameters and point-to-point connections are covered. Accuracy, research and use of precision grid are emphasized.

EDR 163 INTRODUCTION TO CAD FOR ELECTRO-MECHANICAL DRAFTING (4)
Orientation to system's user H/W and S/W, terminology, user protocol, industry applications, introduction to the 4D CAD applications program-2D drawings, texting, auto-dimensioning, elementary 3D functions.

EDR 251 ADVANCED CIRCUITRY I (12.5)
PCB for analog circuitry single and double sided format. Special considerations for EMI, RFI heat dissipation, high voltage/current and component proximity requirements. PCB generation-layout, artwork documentation.

EDR 261 CAD FOR 2D APPLICATIONS I (4)
This course is intended to accompany EDR 251. Content emphasis: CAD generated schematics-library building, user defined menu for symbology, texting, formatting; file manipulation, storage, retrieval, grouping, revisioning, plotting.

SUPPORT COURSES

		CREDITS
MAT 101	Intermediate Algebra	5
MAT 105	Elementary Functions	5
	- OR -	
MAT 111	Technical Math (Algebra)	5
MAT 112	Technical Math (Trig.)	5

ENG 101	Composition	5
ENG 108	Technical Report Writing	5
	- OR -	
SPE 100	Basic Speech Communications	5

EET 110	Survey Of Electronics I (For non-majors)	3
EET 151	Programming In Basic	5
	- OR -	
CSC 100	Intro. To Computer Prog.	5
	- OR -	
CSC 110	Computer Prog. In Basic	5
	- OR -	
DAT 110	Computer Literacy	3

NORTH SEATTLE COMMUNITY COLLEGE

VOCATIONAL EDUCATION
Electronics Division

ELECTRONIC DRAFTING TECHNICIAN
DEGREE OPTION

	COURSE NO.	REQUIRED COURSE SUGGESTED SEQUENCE	LECTURE HOURS	LAB HOURS	CREDIT HOURS	TOTAL CREDITS
1st	EDR 151	Electro-Mechanical Drafting I	55	165	12.5	
Qtr.	MAT 111	Technical Mathematics-Algebra	55	0	5.0	
	ENG 101	Composition	55	0	5.0	22.5
2nd	EDR 152	Electro-Mechanical Drafting II	55	165	12.5	
Qtr.	MAT 112	Technical Mathematics-Alg/Trig.	55	0	5.0	
	EET 151	Intro. to Programming-BASIC	55	0	5.0	22.5
3rd	EDR 153	Electro-Mechanical Drafting III	55	165	12.5	
Qtr.	EDR 163	Intro.to CAD for Electro-Mech.Drft.	22	44	4.0	
	ENG 108	Technical Report Writing	55	0	5.0	21.5
4th	EDR 251	Advanced Circuitry I	55	165	12.5	
Qtr.	EDR 261	CAD for 2D Applications I	22	44	4.0	
	EET 110	Survey of Electronics I	22	22	3.0	19.5
5th	EDR 252	PCB Fab/Photo Processes	55	165	12.5	
Qtr.	EDR 262	CAD for 2D Applications II	22	44	4.0	
	EET 210	Survey of Electronics II	22	22	3.0	19.5
6th	EDR 253	Advanced Circuitry II	55	165	12.5	
Qtr.	EDR 263	CAD For 2D Applications III	55	0	4.0	19.5
	SOC 2xx	Interpersonal Skills in Work Place	33	0	3.0	
				TOTAL REQUIRED CREDITS		123

SUBSTITUTIONS/COURSE WAIVERS/ADVANCED PLACEMENT

1. ADVANCED PLACEMENT is available by instructor's permission only for EDR 151, 152, 153.
2. COURSE WAIVER is available for ENG 101, MAT 111, 112; EET 151, 110 where proof of equal or greater competency is submitted and approved by instructor(s).
3. MAT 111, 112 may be substituted by MAT 101 & 105.
4. ENG 108 may be substituted by SPE 100.

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MAJOR EMPHASIS COURSES:

EDR 151 ELECTRO-MECHANICAL DRAFTING I (12.5)
An introduction to the basic skills of mechanical drafting as they relate to the electronics manufacturing industry. The course describes the industrial environment and employment arenas for an entry-level electro-mechanical drafter. Emphasis is placed on appropriate technical and social behavior to compliment the target industry. Course content includes: basic mechanical drafting concepts, ANSI, MIL-STDS, descriptive geometry, beginning mechanical assemblies.

EDR 152 ELECTRO-MECHANICAL DRAFTING II (12.5)
Emphasis on advanced mechanical assemblies; advanced dimensioning and tolerancing, fasteners, subassy's and final assemblies. Introduction to sheet metal drafting for electronics packaging; dimensioning format, fasteners, flat patterns, fabrication processes.

EDR 153 ELECTRO-MECHANICAL DRAFTING III (12.5)
Drafting for electronics including schematic diagrams, logic diagrams and introduction to printed circuit board generation - layout, artwork and documentation. Symbology, reference designations, diagram format, component representation, board outline parameters and point-to-point connections are covered. Accuracy, research and use of precision grid are emphasized.

EDR 163 INTRODUCTION TO CAD FOR ELECTRO-MECHANICAL DRAFTING (5)
Orientation to system's user H/W and S/W, terminology, user protocol, industry applications, introduction to the 4D CAD applications program - 2D drawings, texting, auto-dimensioning, elementary 3-D functions.

EDR 251 ADVANCED CIRCUITRY I (12.5)
PCB for analog circuitry single and double sided format. Special considerations for EMI, RFI, heat dissipation, high voltage/current and component proximity requirements. PCB generation - layout, artwork, documentation.

EDR 261 CAD FOR 2D APPLICATIONS I (4)
This course is intended to accompany EDR 251. Content emphasis: CAD generated schematics - library building, user-defined menu for symbology, texting, formatting, file manipulation, storage, retrieval, grouping, revisioning, plotting.

EDR 252 PCB FAB/PHOTO PROCESSES (12.5)
This course acquaints the student with principles and techniques of photo tooling: hand-generated artwork photo tooling, photo tooling as a CAD post-process; photographic development, materials and touch-up. Lecture, lab and field trip experiences.

EDR 262 CAD FOR 2D APPLICATIONS II (4)
A continuation of EDR 261. Panel and board outline design. Component outlines/placement. PT-TO-PT connections for analog and low-density circuitry.

EDR 253 ADVANCED CIRCUITRY II (12.5)
PCB for digital circuitry double and multilayer format. Special considerations. High density, layout for x-y, auto-insertion requirements, surface mounted devices, bussing, buried via's, sockets, headers, connection devices.

EDR 263 CAD FOR 2D APPLICATIONS III (4)
This course is to accompany EDR 253. The PCB project developed in EDR 253 will be digitized and entered into the CAD system. Cell creation, net listing; ID of layers are supporting CAD activities.

SUPPORT COURSES

MAT 101	Intermediate Algebra	5 Credits
MAT 105	Elementary Functions	5
	- OR -	
MAT 111	Technical Math (Algebra)	5
MAT 112	Technical Math (trigonometry)	5

ENG 101	Composition	5
ENG 108	Technical Report Writing	5
	- OR -	
SPE 100	Basic Speech Communications	5

EET 110	Survey Of Electronics I For non-majors	3
EET 151	Programming In Basic	5
	- OR -	
CSC 100	Intro. to Computer Programming	5
	- OR -	
CSC 110	Computer Programming In Basic	5
	- OR -	
DAT 110	Computer Literacy	3
EET 210	Survey of Electronics II	3

SOC 2xx	Interpersonal Skills in the Work Place	3

NORTH SEATTLE COMMUNITY COLLEGE

VOCATIONAL EDUCATION
Electronics Division

ELECTRONIC PACKAGING-DESIGN TECHNICIAN
DEGREE OPTION

	COURSE NO.	REQUIRED COURSES Suggested Sequence	LECTURE HOURS	LAB HOURS	CREDIT HOURS	TOTAL CREDITS
1st.	EDR 151	Electro-Mechanical Drftg. I	55	165	12.5	
Qtr.	MAT 111	Technical Mathematics-Algeb.	55	0	5.0	
	ENG 101	Composition	55	0	5.0	22.5
2nd.	EDR 152	Electro-Mech. Drftg. II	55	165	12.5	
Qtr.	MAT 112	Technical Math.-Alg-Trig.	55	0	5.0	
	EET 151	Intro.to Program. Basic	55	0	5.0	22.5
3rd.	EDR 153	Electro-Mech. Drftg. III	55	165	12.5	
Qtr.	EDR 163	Intro.to CAD for Electro-Mech.Drft.	22	44	4.0	
	ENG 108	Technical Report Writing	55	0	5.0	21.5
4th.	EDR 271	Drftg.with Plast.& Other Pckg.Matls.	55	165	12.5	
Qtr.	EDR 281	CAD for 2D Mech. Applications	22	44	4.0	
	IND 102	Machine Fundamentals (Off Campus)			6.0	23.5
5th.	EDR 272	Electro-Mech. Design Concepts	55	165	12.5	
Qtr.	EDR 282	CAD for 3D Applications I	22	44	4.0	
	IND 103	Machine Tool Prac. I (Off Campus)			6.0	23.5
6th.	EDR 273	Electronic Packaging	55	165	12.5	
Qtr.	EDR 283	CAD for 3D Applications II	22	44	4.0	
	SOC 2xx	Interperson.skills in the Market Place	33	0	3.0	22.5
		TOTAL REQUIRED CREDITS				129

SUBSTITUTIONS - COURSE WAIVERS - ADVANCED PLACEMENT

1. ADVANCED PLACEMENT is available by instructor's permission only for EDR 151, 152, 153.
2. COURSE WAIVER is available for ENG 101, MAT 111, 112, EET 151, where proof of equal or greater competency is submitted and approved by instructor(s).
3. MAT 111,112 may be substituted by MAT 101 & 105.
4. ENG 108 may be substituted by SPE 100.

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MAJOR EMPHASIS COURSES

EDR 151 ELECTRO-MECHANICAL DRAFTING I (12.5)
An introduction to basic skills of mechanical drafting as they relate to the electronics manufacturing industry. This course describes the industrial environment and employment arenas for an entry-level electro-mechanical drafter. Emphasis is placed on approprate technical and social behavior to compliment the target industry. Course content includes: Basic mechanical drafting concepts, ANSI, MIL-STDS, descriptive geometry, beginning mechanical assemblies.

EDR 152 ELECTRO-MECHANICAL DRAFTING II (12.5)
Emphasis on advanced mechanical assemblies; advanced dimensioning and tolerancing, fasteners, subassy's and final assemblies. Introduction to sheet metal drafting for electronics packaging; dimensioning format, fasteners, flat patterns, fabrication processes.

EDR 153 ELECTRO-MECHANICAL DRAFTING III (12.5)
Drafting for electronics including schematic diagrams, logic diagrams and introduction to printed circuit board generation-layout, artwork and documentation. Symbology, reference designations, diagram format, component representation, board outline parameters and point-to-point connections are covered. Accuracy, research and use of precision grid are emphasized.

EDR 163 INTRODUCTION TO CAD FOR ELECTRO-MECHANICAL DRAFTING (4)
Orientation to systems user H/W and S/W, terminology, user protocol, industry applications, introduction to the 4D CAD applications program - 2D drawings, texting, auto-dimensioning, elementary 3D functions.

EDR 271 DRAFTING PLASTICS AND OTHER PACKAGING MATERIALS (12.5)
Designs and process considerations for plastic, ferrous and non-ferrous metals. Materials definitions through their chemical and physical properties. Lab, lecture and field trip experiences. 2-3 design projects will be chosen and developed by the student.

EDR 281 CAD FOR 2D MECHANICAL APPLICATIONS (4)
Panel layouts, auto-dimensioning, formatting and drawing for NC and CNC process operations, library building, user-defined menu for symbology and primitives, file manipulation: storage, retrieval grouping, revisioning; plotting.

EDR 272 ELECTRO-MECHANICAL DESIGN CONCEPTS (12.5)
An advanced applications course including: industrial design requirements-standards, safety, fabrication; design proposal-costing, package, MFG. breakdown, scheduling; package design - layout techniques, mechanisms, inter-connections, prototyping, vendor research; design analysis - cost, documentation, testing. Lab, lecture, field trips.

EDR 282 CAD FOR 3D APPLICATIONS I (4)
Mechanical drafting using orthographics, isometrics and rotational functions. 3-D construction, auto-dimensioning, formatting, storage, plotting.

EDR 273 ELECTRONIC PACKAGING (12.5)
An advanced applications course including: design study, layout and documentation principles for mechanical packaging designs for electronic products. Drawing trees, Tolerance studies, interference studies.

EDR 283 CAD FOR 3-D APPLICATIONS II (4)
Intended to accompany EDR 273 to support the package design. Layout applications, interferernce studies and assembly documentation - pictorial, exploded, sectioned and parts listing.

SUPPORT COURSES

MAT 101	INTERMEDIATE ALGEBRA	(5)
MAT 105	ELEMENTARY FUNCTIONS	(5)
	- OR -	
MAT 111	TECHNICAL MATHEMATICS (ALGEBRA)	(5)
MAT 112	TECHNICAL MATHEMATICS (TRIGONOMETRY)	

ENG 101	COMPOSITION	(5)
ENG 108	TECHNICAL REPORT WRITING	(5)
	- OR -	
SPE 100	BASIC SPEECH COMMUNICATIONS	(5)

EET 151	PROGRAMMING IN BASIC	(5)
	- OR -	
CSC 100	INTRODUCTION TO COMPUTER PROGRAMMING	(5)
	- OR -	
CSC 110	COMPUTER PROGRAMMING IN BASIC	(5)
	- OR -	
DAT 110	COMPUTER LITERACY	(3)
IND 102	MACHINE FUNDAMENTALS	(6)
IND 103	MACHINE TOOL PRACTICES	(6)

SOC 2xx Interpersonal Skills in the Work Place (3)

NORTH SEATTLE COMMUNITY COLLEGE

COURSE OUTLINE

DIVISION: Electronics Technology

CURRICULUM: Electro-Mechanical Drafting - Core Curriculum

COURSE TITLE: Electro-Mechanical Drafting I

COURSE NUMBER: EDR 151 QUARTER-HOURS CREDIT: 12.5

TYPE OF COURSE: Occupational Preparatory

COURSE DESCRIPTION:
An introduction to the basic skills of mechanical drafting as they relate to the electronics manufacturing industry. This course describes the industrial environment and employment arenas for an entry level electro-mechanical drafter. Emphasis is placed on approprate technical and social [illegible]or to compliment the target industry.

COURSE OBJECTIVES:
1. To be able to use lab equipment
2. To develop industry level skills in lettering & line work
3. To understand formatting & reprographics for engineering drafting
4. To apply principles of orthographic projections
5. To apply basic mechanical drafting principles
6. To apply the basic principles of descriptive geometry
7. To understand and apply the basic principles of drawings for assemblies
8. To become aware of industry & national standards.

LENGTH OF COURSE: 1 Quarter (11wks) - 220 hrs: 55 hrs lecture/165 hrs Lab

CLASS SIZE: 20 maximum

PREREQUISITES: Program Approval

REQUIRED TEXTS: TECHNICAL DRAWING by Giesecke, Miller, Spencer, Dygdon/7th Edition

ADDITIONAL REFERENCES: DOD 100, MIL-STD-1000, ANSI Y14, Industry Drafting Manuals

TOPICAL OUTLINE: CLOCK HOURS: 20/wk

OUTLINE DEVELOPED BY: NV Snyder DATE: September 1984

TOPICAL OUTLINE-EDR 151

I INTRODUCTION

A. Class & Lab Procedures & Policies
B. Equipment Care? Usage.
C. E-M Drafting in Industry

II ENGINEERING DOCUMENTATION

A. Format
B. Documentation Systems
C. Drawing Levels
D. Industry & National Standards

III REPROGRAPHICS

A. Methods
B. Drafting Media
C. Standard Lettering & Line Quality

IV PRINCIPLES OF 2D & 3D DRAWINGS

A. Formatting
B. X-Y Coordinates/Plotting Points, Lines, Angles
C. Geometric Construction
D. Orthographic Projection

V INTRODUCTION TO MECHANICAL DRAFTING

A. Multi-View Drawings
B. Sectioning
C. Detailing
D. Partial & Exterior Views
E. RH, LH, & Rotated Views

VI PRINCIPLES OF APPLIED DESCRIPTIVE GEOMETRY

A. Geometric Elements
B. Projections of Points, Lines, Planes & Solids
C. View Developments

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VII PRINCIPLES OF DIMENSIONING

A. Datum Plane
B. Datum Dim.
C. Feature Dim.
D. Centerline Dim.
E. Feature Callouts
F. Placement of Dimensioning

VIII INTRODUCTION TO FABRICATION & ASSEMBLY DRAWINGS

A. Drawing Levels & Organization
B. Parts Listing
C. Pictorial Representation

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NORTH SEATTLE COMMUNITY COLLEGE

COURSE OUTLINE

DIVISION: Electronics Technology

CURRICULUM: Electro-Mechanical Drafting Technician Certificate & Degree Options

COURSE TITLE: Electro-Mechanical Drafting II

COURSE NUMBER: EDR 152

TYPE OF COURSE: Occupational Preparatory

COURSE DESCRIPTION: This course is the 2nd level in a series of three which covers drafting concepts for electro-mechanical drafting. This level's emphasis is in advanced mechanical assembly drawing practices & concepts: advanced dimensioning & tolerancing per ANSI Y14.5, fasteners, and subassembly and final assembly. The last third of the course covers general practices for sheet metal drafting: dimensioning, format, flat patterns, fasteners/subassemblies, and processes.

COURSE OBJECTIVES:
1. To apply the basic mechanical drafting concepts for the development of fabrication drawings for mechanical assemblies.
2. To know and apply principles of dimensioning & tolerancing per ANSI Y14.5.
3. To recognize, understand and place into drawing contents standardized fastener information.
4. (see attached)

LENGTH OF COURSE: 1 quarter (11 weeks) - 220 hours - 55 hrs. lecture/165 hrs. lab

CLASS SIZE: 20 maximum

PREREQUISITES: EDR 151 or equivalent

REQUIRED TEXTS: TECHNICAL DRAWING, Giesecke, Miller, Spencer, Dygson - 7th Edition - MacMillen

ADDITIONAL REFERENCES: ANSI Y14.5, Industry design manuals, Parts vendors specifications.

TOPICAL OUTLINE: (see attached) CLOCK HOURS: 20

OUTLINE DEVELOPED BY: NV Snyder DATE: September 1984

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OBJECTIVES

4. To develop subassembly and final assembly documentation

5. To understand and apply principles of sheet metal drafting for electronic packaging

TOPICAL OUTLINE -EDR 152

I ADVANCED MECHANICAL DRAFTING CONCEPTS

- A. Dimensioning per ANSI Y14.5
- B. Muliti-view, Multi-sheet drawings
- C. Tolerancing per ANSI
  1. Form (geometric)
  2. Locational (positional)
  3. Cylindrical fits applications
  4. Fastener tolerances

II SUB-ASSEMBLY CONCEPTS

- A. Threaded/non-threaded fasteners
- B. Inseparable vs. separable assembly
- C. View choices
- D. Parts listing

III FINAL ASSEMBLY

- A. View(s) Choice(s)
  1. Pictorial
  2. Orthogonal
- B. Parts listing
  1. Manufactured items
  2. Purchased parts
  3. Item callouts
- C. Fastener Research
  1. Specification numbers
  2. Mechanical Parameters

IV SHEET METAL DRAFTING

A. Format

B. Processes vs Documentation

C. Dimensioning

1. X-Y
2. O-O
3. Tabular
4. Feature

D. Bent Up

E. Flat Pattern Development

F. Sheet Metal Subassemblies

G. Chassis Assemblies

H. Hardware

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NORTH SEATTLE COMMUNTIY COLLEGE

COURSE OUTLINE

DIVISION: Electronics Technology

CURRICULUM: Electro-Mechanical Drafting Technician Certificate & Degree Options

COURSE TITLE: Electro-Mechanical Drafting III

COURSE NUMBER: EDR 153 QUARTER-HOURS CREDIT: 12.5

TYPE OF COURSE: Occupational Preparatory

COURSE DESCRIPTION: This course is the 3rd level in a series of three which covers drafting concepts for electro-mechanical drafting. Emphasis is placed on electronic drafting: Schematic and logic diagrams, and an intro printed circuit board layout and its documentation. Topics covered, include: Standard symbology, reference designations, diagram formats, component representation, board design and PT-to-PT connections. Accuracy & completeness in design and research are emphasized.

COURSE OBJECTIVES:

1. To recognize and use in context standard (per ANSI Y32.2) electronic symbology and reference designations for analog and digital circuit designs.
2. To understand and develop standard diagramming for analog & digital circuitry.
3. To equate symbology of a functional unit or component to the physical packaging of that unit. (go to attached)

LENGTH OF COURSE: 1 Quarter

CLASS SIZE: 20 maximum

PREREQUISITES: EDR 152 or equivalent

REQUIRED TEXTS: (optional)

ADDITIONAL REFERENCES: ANSI Y32.2, Industry drafting manuals, component vendor specifications and data books.

TOPICAL OUTLINE: (see attached) CLOCK HOURS: 20/wk

OUTLINE DEVELOPED BY: NV Snyder DATE: September 1984

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COURSE OBJECTIVES (CONT'D)

4. To research, define & draft all mechanical constraints of a printed circuit board outline and features.

5. To translate PT-to-PT circuit connections from a diagram to the physical layout.

6. To create a photo-ready artwork of a circuit layout.

7. To develop and draft all supporting documentation.

TOPICAL OUTLINE - EDR 153

I SCHEMATIC DIAGRAMS

- A. Symbology
- B. Reference Designations
- C. ANSI Y32.2
- D. Diagram Flow
- E. Format
- F. Charts

II LOGIC DIAGRAMS

- A. Symbology
- B. Reference Designations
- C. IC Designations and Pin Assignments
- D. Gate I.D.
- E. Circuit Flow
- F. Bussing/Airlines/Voltages/Grounds
- G. Multiple Position Connector Devices
- H. Format
- I. Charts
- J. Data Book Research

III PRINTED CIRCUIT BOARD GENERATION-LAYOUT

- A. Board Outline Development
- B. Component Representation
- C. Component Arrangements
- D. Point-to-Point Connections

IV PCB GENERATION

- A. Grid Systems
- B. Materials
- C. Artwork Systems
- D. Cutting & Pad Placement Techniques

V PCB DOCUMENTATION

A. Fabrication
B. Assembly
C. Component Ident.

VI PCB PROCESSES

A. Automated Drafting (CAD)
   1. Digitizing
   2. Auto Routing

B. Photo Tooling
C. Fabrication
D. Assembly
E. Test

NORTH SEATTLE COMMUNITY COLLEGE

COURSE OUTLINE

DIVISION: Electronics Technology

CURRICULUM: Electro-Mechanical Drafting Technician
& Degree Options

COURSE TITLE: Intro to CAD for Electro-Mechanical Drafting

COURSE NUMBER: EDR 163 Quarter-Hours Credit: 4

TYPE OF COURSE: Occupational Preparatory

COURSE DESCRIPTION:
1. To have an appreciation for CAD as it is used in the electronics industry
2. To properly use and care for all system's user hardware and software elements
3. To become familiar with current CAD/CAM Terminology
4. To employ elementary program features for 2D, 3D and system maintenance applications

LENGTH OF COURSE: 1 Quarter

CLASS SIZE: 15 Maximum

PREREQUISITES: Intro to computer programming or permission

REQUIRED TEXTS: (To be announced) (Optional)

ADDITIONAL REFERENCES:

TOPICAL OUTLINE: (see attached) CLOCK HOURS: 6 Hrs/wk

OUTLINE DEVELOPED BY: NV Snyder DATE: September 1984

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TOPICAL OUTLINE - EDR 163

I INTRODUCTION

- A. CAD/CAM Terminology
- B. Applications in Industry
- C. System Types

II EQUIPMENT AWARENESS

- A. Terminology
- B. ID
- C. Proper Handling & Use

III CLASSROOM & LAB PROCEDURES

- A. Scheduling
- B. Lab Maintenance
- C. Files & Discs

IV SYSTEMS OPERATION

- A. System Boot
- B. Verb-Noun Processor
- C. Graphics Command Processor

V. MENUS

- A. Tablet
- B. On-Screen
- C. User-Defined

VI DRAWING SET-UP

- A. Grid
- B. Layers
- C. Line Widths
- D. Text Size & Style
- E. Depth
- F. Screen Graphics Display Parameters
- G. Chord Height
- H. Entity Trap Distance

VII DATA MANAGEMENT

- A. Drawing Storage
- B. Back-Up Routines

VIII DISPLAY MANAGEMENT

A. Editing
B. Change Commands
C. Windowing
D. Rotating Commands

IX 2-D DRAWING

A. Draw Commands
B. Measure Commands
C. Dimensioning

X ANNOTATION

A. Execute Command
B. Text

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NORTH SEATTLE COMMUNITY COLLEGE

COURSE OUTLINE

DIVISION: ELECTRONICS TECHNOLOGY

CURRICULUM: ELECTRO-MECHANICAL DRAFTING TECHNICIAN CERTIFICATE & DEGREE OPTIONS

COURSE TITLE: ADVANCED CIRCUITRY I

COURSE NUMBER: EDR 251 QUARTER HOURS CREDIT: 12.5

TYPE OF COURSE: OCCUPATIONAL PREPARATORY

COURSE DESCRIPTION: Emphasis placed onprinted circuit board design for analog circuitry. Single and double-sided board format. Special considerations for EMI. RFI, Heat Dissipation, High Voltage/Current, and component proximity requirements generation of a complete PCB package; diagram, layout, artwork and documentation. *Note*

COURSE OBJECTIVES:

1. To have an appreciation for analog circuitry concepts
2. To recognize and account for special considerations in a board layout design
3. To generate a complete analog PCB package-to include:
   a. Diagram
   b. Layout
   c. Camera Ready Artwork
   d. Documentation

LENGTH OF COURSE: 11 weeks

CLASS SIZE: 20 students *Note* This course parallels information covered in EET 110 and should be taken simultaneous or after EET 110.

PREREQUISITES: EDR 153 or permission

REQUIRED TEXTS: None

ADDITIONAL REFERENCES: ANSI Y32.2, Component specifications, other industry standards

TOPICAL OUTLINE: SEE ATTACHED CLOCK HOURS: 20/wk

OUTLINE DEVELOPED BY: Nancy V. Snyder DATE: September 1984

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TOPICAL OUTLINE - EDR 251

I ANALOG CIRCUITRY CONCEPTS FOR PCB GENERATION

- A. Capacitance
- B. Resistance
- C. Transistor Functions
- D. Current/Voltage/Power Supplies
- E. Grounding
- F. Amplifier Functions

II SPECIAL CONSIDERATIONS

- A. EMI
- B. RFI
- C. Heat Dissipation
- D. High Voltage

III ANALOG PCB LAYOUT/ARTWORK

- A. Single Sided
- B. Double Sided
- C. Planning/Multilayer
- D. Board Outline
  - 1. Mechanical Parameters
  - 2. Connector Devices
  - 3. Adjustable Components
- E. Component Representation
  - 1. Research
  - 2. Puppet Development
- F. Component Placement
  - 1. Proximity
  - 2. Shielding/Guarding
  - 3. Auto Insertion
  - 4. Clocking

IV DOCUMENTATION

- A. Fabrication
- B. Assembly
- C. Component ID.

NORTH SEATTLE COMMUNITY COLLEGE

COURSE OUTLINE FORM

COURSE NUMBER: EDR 252 CREDITS: 12.5 DATE: Dec.15, 1984

COURSE TITLE: PCB FAB & Photo Tooling Processes

DIVISION: Electronics Technology CLASS SIZE: 20

INSTITUTIONAL INTENT: Occupational preparatory HEGIS: _____

CURRICULUM/DEGREE/CERT.: Electronics Drafting Technician Degree

DISTRIBUTION: Electronic Technology

TRANSFERABILITY: None

SPECIAL FEES: (Photo Tooling) $10.00 approx. COURSE LENGTH: 1 Qtr. 11 Weeks

COURSE HOURS: _____ Lecture: 55 Lab: 165 Clinical: _____

PREREQUISITES: EDR 251

MAY COURSE BE CHALLENGED: No REQUIRED PRE-TESTS: None

COURSE DESCRIPTION:

This course acquaints the student with principles and techniques of photo tooling: hand-generated artwork photo tooling, photo tooling as a CAD post-process; photographic development, materials and touch-up. Lecture, lab and field trip experiences.

COURSE OBJECTIVES:

I. To become familiar with the total manufacturing processes sequence of printed circuit board technology.

II. To further understand photo tooling as a.) a post-process of a CAD generated printed circuit board and b.) an intermediate link between a manually generated PCB and it's fabrication.

III. To become familiar with fabrication processes of a printed circuit board.

IV. To become familiar with assembly procedures for printed circuit boards.

V. To be able to summarize good design techniques in order to maximize the manufacturability of the print circuit board.

COURSE CONTENT:

I. Review of printed circuit board generation from design through to assembly
II. Photo tooling for hand-generated artwork
III. Photo plotting for CAD-generated photo tapes
IV. Principles of photographic reduction and development processes
V. Photo tooling touch-up and quality assurance principles
VI. PCB cutting and drilling operations
VII. PCB etching, deposition, plating and masking operations
VIII. PCB assembly operations: Manual, auto insertion and surface mounted technologies
IX. Design implications

COURSE REQUIREMENTS:

I. Review, observe and write a summary of the generation of a printed circuit board
II. Be able to shoot, develop and Q.A. the photo tooling of a manually generated artwork
III. Cut, drill, expose, etch and plate a single-sided prototype PCB
IV. Insert and hand solder the prototype PCB assembly
V. Summarize and draw conclusions in the form of an illustrated lab report what the implications of design are on the manufacturing processes of a PCB

EVALUATION METHOD:

1. One summary report on PCB generation
2. A completed photo set
3. A completed, assembled fabricated board
4. A lab report on implications of design
5. A final test

Supplementary: Instructor hand outs, industry standards

REQUIRED STUDENT MATERIALS/EQUIPMENT: Photo film, paper, PCB Material, etching, plating kit.

OUTLINE PREPARED BY: Nancy Snyder December 15, 1984

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NORTH SEATTLE COMMUNITY COLLEGE

COURSE OUTLINE FORM

COURSE NUMBER: EDR 261 CREDITS: 4 DATE: Dec. 15,1984

COURSE TITLE: CAD FOR 2D APPLICATIONS I

DIVISION: Electronics Technologies CLASS SIZE: 15

INSTITUTIONAL INTENT: Occupational Preparatory HEGIS: ____

CURRICULUM/DEGREE/CERT.: Electronic Drafting Technician Degree

DISTRIBUTION: Electronics Technologies

TRANSFERABILITY: None

SPECIAL FEES: None COURSE LENGTH: 1 Qtr.(11 weeks)

COURSE HOURS: _____ Lecture: 22 Lab: 44 Clinical: _____

PREREQUISITES: EDR 163

MAY COURSE BE CHALLENGED No REQUIRED PRETESTS: None

COURSE DESCRIPTION:

This course is intended to accompany EDR 251. Content empnasis: CAD generated schematics-library building, user-defined menu for symbology, texting, formatting, file manipulation, storage,retrieval, grouping, revisioning, plotting.

COURSE OBJECTIVES:

I. To learn how to develop electronic symbology, using basic drawing command structure
II. To develop a user-defined menu, emphasizing electronic symbology and commands associated with principles of diagramming
III. To be able to apply the use of the menu, the verb-noun processor, and appropriate syntax to create an electronic diagram
IV. To acquire a knowledge of filing, directory and editing commands in order to effect drawing revisions.

COURSE CONTENT:

I.	Review of symbology per ANSI and IEEE
II.	Review of system's graphics and verb-noun processors
III.	Function keys- intro. to macro-programming for diagramming
IV.	Review of standard abbreviations and reference designations per ANSI and IEEE
V.	Texting and editing commands
VI.	Drawing layering commands
VII.	File manipulation and "housekeeping" functions
VIII.	Plotting command and formatting and scaling a formal diagram

COURSE REQUIREMENTS:

I.	To know electronic symbology and how to create individual drawing cells which include the symbol on one layer and associated attributes on subsequent layers
II.	To be able to group cells into standard formatted subcircuits
III.	To develop and plot an individually-defined user menu having the most common electronic device and function symbols
IV.	To develop, format and plot a complete electronic diagram

EVALUATION METHOD:

Quizzes after each major topic of the Course Content and a minimum of five programs used for evaluation

TEXTS: REQUIRED 4DCAD Manual, 1984, current revision

SUPPLEMENTARY instructor handouts, ANSI, IEEE Standards

REQUIRED STUDENT MATERIALS/EQUIPMENT: two double-sided, double-density floppy discs

OUTLINE PREPARED BY: Nancy V. Snyder Dec. 15, 1984

NORTH SEATTLE COMMUNITY COLLEGE

COURSE OUTLINE FORM

COURSE NUMBER: EDR 262 CREDITS: 4 DATE: Dec. 15, 1984

COURSE TITLE: CAD FOR 2D APPLICATIONS II

DIVISION: Electronic Technologies CLASS SIZE: 15

INSTITUTIONAL INTENT: Occupational Preparatory HEGIS: ____

CURRICULUM/DEGREE/CERT.: Electronics Drafting Technician Degree

DISTRIBUTION: Electronics Technologies

TRANSFERABILITY: None

SPECIAL FEES: None COURSE LENGTH: 1 Qtr.(11 weeks)

COURSE HOURS: _____ Lecture: 22 Lab: 44 Clinical: _____

PREREQUISITES: EDR 261, EDR 252, or work exp. in field

MAY COURSE BE CHALLENGED no REQUIRED PRETESTS: None

COURSE DESCRIPTION:

A continuation of EDR 261. Panel and board outline design. Component outlines/placement. Point-to-point connections for analog and low-density circuitry.

COURSE OBJECTIVES:

I. To create sheet metal chassispanel designs in their developed and flat pattern states
II. To develop a series of macro programs to calculate bend allowances given certain mechanical parameters
III. To develop a user-defined menu of electronic component outlines
IV. To be able to apply the use of the menu, the verb-noun processor and appropriate syntax to create a 2D drawing of a PCB outline and component placements
V. To achieve point-to-point circuit connections through string and insert line commands

NORTH SEATTLE COMMUNITY COLLEGE

COURSE OUTLINE FORM

COURSE NUMBER: EDR253 CREDITS: 12.5 DATE: Dec.15, 1984

COURSE TITLE: ADVANCED CIRCUITRY II

DIVISION: Electronics Technologies CLASS SIZE: 20

INSTITUTIONAL INTENT: Occupational Preparatory HEGIS: _____

CURRICULUM/DEGREE/CERT.: Electronics Drafting Technician Degree

DISTRIBUTION: Electronics Technologies

TRANSFERABILITY: None

SPECIAL FEES: None COURSE LENGTH: 1 Qtr.(11 weeks)

COURSE HOURS: _____ Lecture: 55 Lab: 165 Clinical: _____

PREREQUISITES: EDR 252, EDR 262, EET 110

MAY COURSE BE CHALLENGED No REQUIRED PRETESTS: None

COURSE DESCRIPTION:

PCB for digital circuitry-double and multilayer format. Special considerations: high density, layout for X-Y, auto-insertion requirements, surface mounted devices, bussing, buried via's sockets, headers, connection devices.

NOTE

This course parallels information covered in EET 210 and should be taken simultaneous or after EET 210.

COURSE OBJECTIVES:

I. To have an appreciation for digital circuitry concepts.

II. To recognize and account for special considerations in a board layout design.

III. To generate a complete digital PCB package, including:
   A. Diagram
   B. Layout
   C. Camera ready artwork
   D. Documentation

IV. To anticipate a CAD interface for generation of artwork and documentation.

COURSE CONTENT:

I. Digital circuitry concepts for PCB generation.
II. High density design
III. Design for auto-insertion
IV. Design for double-sided and multilayer boards
V. Design for surface mounted technology
VI. Design considerations for readout and display devices
VII. Board interface design considerations
VIII. Documentation
IX. CAD interface--netlisting

COURSE REQUIREMENTS:

I. To be able to do component research for simple and complex logic units
II. To be able to assign simple logic gate functions to component packaging
III. To design and document a complex digital PCB
IV. To generate a complete netlist of the point-to-point relationships of the PCB

EVALUATION METHOD:

1. PCB layout
2. PCB artwork
3. PCB documentation
4. Circuit netlist
5. Compilation of component research in log form
6. Quizzes on special design considerations

TEXTS: REQUIRED _____

SUPPLEMENTARY ANSI Y32.2, comp. specs.,industry stds.

REQUIRED STUDENT MATERIALS/EQUIPMENT: precision grid, artwork media, precision-cut tape and pads

OUTLINE PREPARED BY: Nancy V. Snyder Dec. 15, 1984

NORTH SEATTLE COMMUNITY COLLEGE

COURSE OUTLINE FORM

COURSE NUMBER: EDR 263 CREDITS: 4 DATE: Dec. 15, 1984

COURSE TITLE: CAD FOR 2D APPLICATIONS III

DIVISION: Electronics Technologies CLASS SIZE: 15

INSTITUTIONAL INTENT: Occupational Preparatory HEGIS: ____

CURRICULUM/DEGREE/CERT.: Electronics Drafting Technician Degree

DISTRIBUTION: Electronics Technologies

TRANSFERABILITY: None

SPECIAL FEES: None COURSE LENGTH: 1 Qtr, (11 weeks)

COURSE HOURS: _____ Lecture: 22 Lab: 44 Clinical: _____

PREREQUISITES: EDR 262, EDR 251, EDR 252, EET110 or 210

MAY COURSE BE CHALLENGED No REQUIRED PRETESTS: None

COURSE DESCRIPTION:

This course is to accompany EDR 253. The PCB project developed in EDR 253 will be digitized and entered into the CAD system. Cell creation, net listing, ID of layers and supporting CAD activities.

COURSE OBJECTIVES:

I. To develop a user-defined menu of logic gate symbols
II. To develop a user-defined menu of integrated circuit packaging outlines
III. To develop a series of macro programs for function key usage to increase efficiency and reduce use of disc memory for point-to-point relationships
IV. To be able to apply the use of the menu, supporting drawing command functions, the verb-noun processor and appropriate syntax to create the PCB digital project of EDR 253
V. To be able to sort, identify, and plot all layers of circuit information and other information in single and composite plots

COURSE CONTENT:

I. Course content of digital PCB design of EDR 253 is the s me for the course.
II. Macro development for repeated arrays and pin connections
III. Menu develoment for gate symbols and IC packaging
IV. Digitize a two sided or multilayer PCB
V. Extrapolation of component and other circuit information to list in documentation

COURSE REQUIREMENTS:

I. Development of a repeated characteristic as a macro program
II. Development of a user-defined menu for gate symbols and IC packages
III. Development of the PCB design of EDR 253 on the CAD system
IV. Development of supporting documentation

EVALUATION METHOD:

Hard copies of the following will be evaluated for correctness and completeness:

1. User-defined menu
2. PCB layout
3. PCB fabrication drawing
4. PCB assembly drawing
5. PCB logic diagram

TEXTS: REQUIRED CAD manual, 1984, current revision

SUPPLEMENTARY Instructor handouts

REQUIRED STUDENT MATERIALS/EQUIPMENT: two DS, DD floppy discs

OUTLINE PREPARED BY: Nancy V. Snyder Dec. 15, 1984

NORTH SEATTLE COMMUNITY COLLEGE

COURSE OUTLINE FORM

COURSE NUMBER: EDR 271 CREDITS: 12.5 DATE: Dec. 15, 1984

COURSE TITLE: DRAFTING WITH PLASTICS AND OTHER PACK. MATERIALS

DIVISION: Electronics Technologies CLASS SIZE: 20

INSTITUTIONAL INTENT: Occupational Preparatory HEGIS: ____

CURRICULUM/DEGREE/CERT.: Electronic Pack./Design Technician Degree

DISTRIBUTION: Electronics Technologies

TRANSFERABILITY: None

SPECIAL FEES: None COURSE LENGTH: 1 Qtr.(11 weeks)

COURSE HOURS: _____ Lecture: 55 Lab: 165 Clinical: _____

PREREQUISITES: EDR 152, MAT 112, IND 102

MAY COURSE BE CHALLENGED No REQUIRED PRETESTS: None

COURSE DESCRIPTION:

Designs and process considerations for plastic, ferrous and non-ferrous metals. Materials definition through chemical and physical properties. Lab, lecture and field trip experiences. Two-Three design projects will be chosen and developed by the student.

COURSE OBJECTIVES:

I. To become familiar with physical and chemical properties of major industrially-used polymer materials
II. To become familiar with physical and chemical properties of ferrous and non-ferrous materials used in engineering design applications
III. To become familiar with industrial fabrication processes for polymer materials
IV. To become familiar with fabrication processes for ferrous and non-ferrous metals
V. To be able to draw conclusions on material choice and fabrication requirements for design implementation
VI. To know specific drafting requirements for the documentation of plastic design parts

COURSE CONTENT:

I. Introduction to polymer chemistry
II. Physical properties of engineering plastics
III. Manufacturing processes of plastics
IV. Design guidelines for the use of plastics
V. Drafting for plastics
VI. Introduction to the chemistry of metals used in engineering design
VII. Physical properties of engineering metals
VIII. Manufacturing processes of metals
IX. Design guidelines for the use of various engineering metals
X. Drafting for metal fabrication

COURSE REQUIREMENTS:

I. To know the chemical and commercial name of key plastics and engineering metals
II. To know the "family membership" of key plastics and metals
III. To know the performance characteristics of key plastics and metals
IV. To be able to choose a polymer material and fabrication process for a specific design application
V. To be able to choose an engineering metal and fabrication process for a specific design application

EVALUATION METHOD:

1. Quizzes after each topic of the Course Content
2. Final test
3. Two performance projects

TEXTS: REQUIRED To be announced

SUPPLEMENTARY Instructor handouts

REQUIRED STUDENT MATERIALS/EQUIPMENT: Notebook, drafting equipment and supplies

OUTLINE PREPARED BY: Nancy V. Snyder Dec. 15, 1984

NORTH SEATTLE COMMUNITY COLLEGE

COURSE OUTLINE FORM

COURSE NUMBER: EDR 281 CREDITS: 4 DATE: Dec. 15, 1984

COURSE TITLE: CAD FOR 2D MECHANICAL APPLICATIONS

DIVISION: Electronics Technologies CLASS SIZE: 15

INSTITUTIONAL INTENT: Occupational Preparatory HEGIS: ____

CURRICULUM/DEGREE/CERT.: Electronics Pack./Design Technician Degree

DISTRIBUTION: Electronics Technologies

TRANSFERABILITY: None

SPECIAL FEES: None COURSE LENGTH: 1 Qtr.(11 weeks)

COURSE HOURS: _____ Lecture: 22 Lab: 44 Clinical: _____

PREREQUISITES: EDR 163

MAY COURSE BE CHALLENGED No REQUIRED PRETESTS: None

COURSE DESCRIPTION:

Panel layouts, auto-dimensioning, formatting and drawing for NC and CNC process operations, library building, user-defined menu for symbology and primitives, file manipulation:storage, retrieval, grouping, revisioning; plotting

COURSE OBJECTIVES:

I. To create sheet metal chassis panel designs in their developed and flat pattern states

II. To develop a series of Macro programs to calculate bend allowances given certain mechanical parameters

III. To employ auto-dimensioning for flange and notch sizes

IV. To develop a user-defined menu for hardware symbology and other symbols for sheet metal applications

V. To be able to use the menu, the verb-noun processor and appropriate syntax to create a 2D drawing of a sheet metal chassis panel

COURSE CONTENT:

I. Macro program using function keys for bend allowances
II. Digitize 2D chassis flat pattern, developed on X-Y coordinate data of all features
III. File manipulation to develop programming and tooling charts
IV. Format and plot commands for a 2D chassis panel drawing
V. Texting and editing commands
VI. File manipulation and "housekeeping" functions

COURSE REQUIREMENTS:

I. To create a macro program which calculates the bend allowance of a sheet metal panel design
II. To complete a 2D chassis panel drawing
    A. Flat pattern
    B. 3D side views
    C. Flange dimensioning
    D. Pictorial
    E. X-Y locating coordinates in chart form
    F. Tooling chart
III. To develop a user-defined menu of hardware symbology

EVALUATION METHOD:

Graded hard copies of:
1. Macroprogram
2. 2D chassis panel drawing
3. Menu

TEXTS: REQUIRED CAD manual, 1984, current revision

SUPPLEMENTARY Instructor handouts

REQUIRED STUDENT MATERIALS/EQUIPMENT: two DS DD flpopy discs

OUTLINE PREPARED BY: Nancy V. Snyder Dec. 15, 1984

NORTH SEATTLE COMMUNITY COLLEGE

COURSE OUTLINE FORM

COURSE NUMBER: EDR 272 CREDITS: 12.5 DATE: Dec. 15, 1984

COURSE TITLE: ELECTRO-MECHANICAL DESIGN CONCEPTS

DIVISION: Electronics Technologies CLASS SIZE: 20

INSTITUTIONAL INTENT: Occupational Preparatory HEGIS: ____

CURRICULUM/DEGREE/CERT.: Electronic Pack./Design Technician Degree

DISTRIBUTION: Electronics Technologies

TRANSFERABILITY: None

SPECIAL FEES: None COURSE LENGTH: 1 Qtr.(11 weeks)

COURSE HOURS: _____ Lecture: 55 Lab: 165 Clinical: _____

PREREQUISITES: EDR 271, IND 103

MAY COURSE BE CHALLENGED No REQUIRED PRETESTS: None

COURSE DESCRIPTION:

An advanced applications course including: industrial design requirements-standards, safety, fabrication; design proposal-costing, packaging, manufacturing breakdown, scheduling; package design-layout techniques, mechanisms, inter-connections, prototyping, vendor research; design analysis-costing, documentation, testing. Lab, lecture, trips

COURSE OBJECTIVES:

I. To become acquainted with the progression of product development from definition through to manufacture
II. To become familiar with industrial requirements in safety, standards and fabrication
III. To learn the process of product proposal
IV. To develop an understanding of product costing, scheduling and manufacturing planning
V. To be able to iterate package design definition
VI. To become familiar with design layout techniques
VII. To become familiar with the design/drafting management role of product development

COURSE CONTENT:

I. Steps of product development
II. Safety standards-UL, FAA, FDA, IEEE
III. Fabrication standards
IV. Production proposal
V. Product costing
VI. Product development scheduling
VII. Manufacturing planning
VIII. Design layout techniques
IX. Design/drafting role in product development

COURSE REQUIREMENTS:

I. A product proposal in report form
II. Design/drafting department configuration and assignment of responsibilities
III. Schedules definition
  A. Design/drafting events
  B. Fabrication events
  C. Prototype
  D. Revision for hardmodel
IV. Product costing
  A. Engineering-design/drafting/CAD
  B. Manufacturing
  C. Materials
  D. Testing
V. Design layout of product

EVALUATION METHOD:

I. Report containing:
  A. Product proposal
  B. Product cost
  C. Scheduling
  D. Department configuration
II. A mulilayer/multicolor design layout

TEXTS: REQUIRED To be announced

SUPPLEMENTARY Instructor handouts

REQUIRED STUDENT MATERIALS/EQUIPMENT: Drafting supplies/equip., precision grid

OUTLINE PREPARED BY: Nancy V. Snyder Dec. 15, 1984

NORTH SEATTLE COMMUNITY COLLEGE

COURSE OUTLINE FORM

COURSE NUMBER: EDR 282 CREDITS: 4 DATE: Dec. 15, 1984

COURSE TITLE: CAD FOR 3D APPLICATIONS I

DIVISION: Electronics Technologies CLASS SIZE: 15

INSTITUTIONAL INTENT: Occupational Prparatory HEGIS: ____

CURRICULUM/DEGREE/CERT.: Electronics Pack./Design Technician Degree

DISTRIBUTION: Electronics Technologies

TRANSFERABILITY: None

SPECIAL FEES: None COURSE LENGTH: 1 Qtr.(11 weeks)

COURSE HOURS: _____ Lecture: 22 Lab: 44 Clinical: ____

PREREQUISITES: EDR 281

MAY COURSE BE CHALLENGED No REQUIRED PRETESTS: None

COURSE DESCRIPTION:

Mechanical CAD drafting using orthographics, isometrics, and rotational functions. 3D construction, auto-dimensioning, formatting, storage, plotting

COURSE OBJECTIVES:

I. To become familiar with the 3D capabilities of the 4D CAD system
II. To utilize auto-dimensioning functions
III. To utilize texting functions
IV. To be able to create drawing files and subfiles for auxiliary views, details, inserts
V. To be able to scale, format and plot formal 3D engineering drawings

COURSE CONTENT:

I. Graphics and verb-noun processor commands
II. Edit and file commands
III. Object rotation commands
IV. Scaling commands
V. Plotting and format commands
VI. Texting commands
VII. Auto-dimensioning commands

COURSE REQUIREMENTS:

I. To know command structures to create multiple views of a 3D design
II. To employ appropriate drafting standards of view orientation and view references
III. To employ ANSI standards for dimensioning a 3D mechanical design
IV. To create and plot formal 3D mechanical

EVALUATION METHOD:

1. Quizzes over 3D command structure
2. 2-3 3D CAD generated sketches
3. One formal 3D drawing
4. Final test

TEXTS: REQUIRED CAD manual, 1984, current revision

SUPPLEMENTARY Instructor handouts

REQUIRED STUDENT MATERIALS/EQUIPMENT: Two DS DD floppy discs

OUTLINE PREPARED BY: Nancy V. Snyder Dec. 15, 1984

NORTH SEATTLE COMMUNITY COLLEGE

COURSE OUTLINE FORM

COURSE NUMBER: EDR 273 CREDITS: 12.5 DATE: Dec. 15, 1984

COURSE TITLE: ELECTRONIC PACKAGING

DIVISION: Electronics Technologies CLASS SIZE: 20

INSTITUTIONAL INTENT: Occupational Preparatory HEGIS: ____

CURRICULUM/DEGREE/CERT.: Electronic Pack./Design Technician Degree

DISTRIBUTION: Electronics Technologies

TRANSFERABILITY: None

SPECIAL FEES: None COURSE LENGTH: 1 Qtr.(11 weeks)

COURSE HOURS: _____ Lecture: 55 Lab: 165 Clinical: _____

PREREQUISITES: EDR 272, EDR 282, IND 103

MAY COURSE BE CHALLENGED No REQUIRED PRETESTS: None

COURSE DESCRIPTION:

An advanced applications course including: design study, layout and documentation principles for mechanical packaging designs for electronic products. Drawing trees, tolerance studies, interference studies. This is a continuation of EDR 272.

COURSE OBJECTIVES:

I. To complete the multilayer, multicolor design layout started in EDR 272
II. To learn the process of tolerance checks
III. To know how to develop drawing trees for documentation organization
IV. To learn design/drafting task management to document an engineering design

COURSE CONTENT:

I. Design layout activities
II. Drawing breakdown using a drawing tree
III. Clearance studies, interference checks
IV. Tolerance studies
V. Hardware and flange design studies
VI. Front and rear panel designs

COURSE REQUIREMENTS:

I. Completion of design layout
II. A drawing tree and drawing assignment schedule
III. Interference check and tolerance study in log report form
IV. Compilation of hardware research
V. Front and rear panel designs-cutout and decal

EVALUATION METHOD:

1. Design layout
2. Drawing tree
3. Project report to include:
   a. Tolerance/interference studies
   b. Hardware research data and specification sheets
   c. Scheduling for drafting
4. Concept sketch of front and rear panel designs

TEXTS: REQUIRED To be announced

SUPPLEMENTARY Instructor handouts

REQUIRED STUDENT MATERIALS/EQUIPMENT: Drafting supplies/ equipment,precision grid

OUTLINE PREPARED BY: Nancy V. Snyder Dec. 15, 1984

NORTH SEATTLE COMMUNITY COLLEGE

COURSE OUTLINE FORM

COURSE NUMBER: EDR 283 CREDITS: 4 DATE: Dec. 15, 1984

COURSE TITLE: CAD FOR 3D APPLICATIONS II

DIVISION: Electronics Technologies CLASS SIZE: 15

INSTITUTIONAL INTENT: Occupational Preparatory HEGIS: ____

CURRICULUM/DEGREE/CERT.: Electronic Pack./Design Technician Degree

DISTRIBUTION: Electronics Technologies

TRANSFERABILITY: None

SPECIAL FEES: None COURSE LENGTH: 1 Qtr.(11 weeks)

COURSE HOURS: _____ Lecture: 22 Lab: 44 Clinical: _____

PREREQUISITES: EDR 272, EDR 282

MAY COURSE BE CHALLENGED No REQUIRED PRETESTS: None

COURSE DESCRIPTION:

Intended to accompany EDR 273 to support the package design. Layout applications, interference studies and assembly documentation-pictorial, exploded, sectioned and parts listing.

COURSE OBJECTIVES:

I. To utilize the 3D capabilities to create the design layout developed in EDR 273
II. To be able to use auto-dimensioning to center-line dimersion in all three dimensional axes
III. To be able to separate the design layout into layers of information using layer assignment commands
IV. To be able to extrapolate dimensional data for tolerance and interference checks
V. To be able to create user-defined menu cells for hardware and flange elements
VI. To be able to use editing and filing commands to create drawings from the design layout master file
VII. To develop formal drawings using scaling, texting, formatting and plotting commands

COURSE CONTENT:

I. Multilayer design layout file creation
II. Center-line dimensioning in the X,Y, and Z axes of the chassis assembly
III. Graphic and mathematical tolerance and interference checks
IV. A user-defined menu for A)hardware outlines and symbols; B)Flange configurations
V. Individual part drawings

COURSE REQUIREMENTS:

I. To be able to create a multilayer/multicolor design layout
II. To develop and plot a mechanical user-defined menu
III. To identify and correct interference and tolerance errors
IV. To create drawings of individual parts from the design layout composite

EVALUATION METHOD:

1. Design layout plot
2. Tolerance and interference check plots
3. 2-3 individual part drawings

TEXTS: REQUIRED CAD manual, 1984, current revision

SUPPLEMENTARY Instructor handouts

REQUIRED STUDENT MATERIALS/EQUIPMENT: Two DS DD floppy discs

OUTLINE PREPARED BY: Nancy V. Snyder Dec. 15, 1984